I. Amendment Entry after Final Rejection

Entry of this amendment is proper under 37 CFR §1.116 because the amendments: a) place the application in condition for allowance (for all the reasons discussed herein); b) do not raise any new issues requiring further search or consideration; c) place the application in better condition for appeal (if necessary); and d) address formal requirements of the Final Rejection and preceding Office Action. Accordingly, Applicants respectfully request entry of this Amendment.

II. The Drawings Satisfy All Formal Requirements

The Final Office Action objects to the drawings based on informalities. Figures 1A, 1B and 2 are replaced pursuant to the attached Letter to the Official Draftsperson. Withdrawal of the objection to the drawings is respectfully requested.

III. Claims 1-6 Define Patentable Subject Matter

The Final Office Action rejects claims 1-6 under 35 U.S.C. §103(a) over U.S. Patent 6,284,093 to Ke et al. (Ke) in view of *Silicon Processing for the VLSI Era*, v. 1 by Wolf et al. (Wolf) and U.S. Patent 6,299,982 to Tamatsuka et al. (Tamatsuka). This rejection is respectfully traversed.

Ke, Wolf and Tamatsuka do not teach or suggest a silicon focus ring comprising a silicon single crystal used as a focus ring in a plasma apparatus, wherein a concentration of interstitial oxygen contained in the silicon focus ring is not less than 5×10^{17} atoms/cm^3 and not more than 1.5×10^{18} atoms/cm^3, as recited in claim 1, and as similarly recited for the producing method in claim 5.

Instead, Ke discloses a focus ring preferably composed of pure silicon, so as to avoid the release of contaminants into the chamber. See col. 6, lines 31-38 of Ke. Moreover, Ke discloses that the release of oxygen from the focus ring degrades spatial uniformity of etching, and thus is undesirable. See col. 7, lines 32-43 and col. 8, lines 39-50 of Ke.

Thus, Ke teaches away from the present invention by deliberately avoiding oxygen gettering for a silicon focus ring. Consequently, one of ordinary skill in the art would not consider increasing oxygen concentration in the focus ring, based on Ke, in order to achieve the features of Applicants' claims. Hence, not only does Ke not disclose an oxygen or a nitrogen concentration in the ring or method of forming the ring, as admitted in the Final Office Action on page 3, Ke discourages introducing oxygen into the silicon focus ring. Thus, Ke teaches away from Applicants' claimed features.

Further, Wolf discloses that the incorporation of oxygen in Czochralski silicon increases wafer mechanical strength, but that oxygen can out-diffuse during thermal processing. See pp. 32-33 of Wolf. There is no teaching or suggestion in Wolf for providing interstitial oxygen in a silicon focus ring, as recited in Applicants' claimed features, but rather confirms the oxygen release cited in Ke as a disadvantage.

Additionally, Tamatsuka discloses silicon wafers produced by the Czochralski method, preferably including a concentration of nitrogen between 1×10^{10} atoms/cm^3 and 5×10^{15} atoms/cm^3, for heterogeneous nuclei formation to suppress crystal defects. See col. 4, lines 36-57 of Tamatsuka. Also, Tamatsuka discloses limiting oxygen concentration to 1×10^{18} atoms/cm^3 or less to avoid oxide precipitation. See col. 4, lines 62-65 of Tamatsuka. Thus, Tamatsuka teaches introduction of oxygen as a condition to be tolerated, rather than presenting desired properties, and consequently does not teach or suggest the features of Applicants' claims. Further, Tamatsuka teaches such oxygen concentration as no greater than 1×10^{18} atoms/cm^3, thereby excluding at least a portion of the range as recited in the claims.

The Final Office Action asserts on pages 3 and 4 that it would have been obvious to one of ordinary skill in the art to apply oxygen concentration of a silicon wafer to a focus ring because the material is the same for the wafer and the focus ring, and because etching the

surface of silicon to remove processing damage was known to Wolf for producing a desired result.

Applicants traverse these assertions, however, by asserting that the wafer and the focus ring represent two completely different devices serving separate functions, irrespective of any common material from which they may be predominantly comprised. The design advantages from particular material characteristics for one application are often contrary to those derived for another application. The gettering attributes from oxygen concentration in the silicon focus ring cannot be transferred to the processing of a silicon wafer. Neither Wolf nor Tamatsuka teaches or suggests that the gettering attributes provide any inherent benefit in the wafer industry. Therefore Applicants' features cannot have been obvious at the time of the invention absent hindsight reasoning with benefit of Applicants' disclosure.

The Final Office Action, on page 5, asserts that one of ordinary skill in the art would expect to extend the life of the focus ring through the increased mechanical strength imparted to the silicon by the presence of known amounts of oxygen. The Final Office Action moreover asserts, on page 6, that using a known material (i.e., silicon) with known properties (i.e., at known oxygen concentrations) in a known apparatus component (i.e., a focus ring) must be obvious to an artisan of ordinary skill in the art.

Applicants respectfully traverse these assertions by arguing that conventionally, a focus ring is made of pure silicon, while the Applicants' claims recite interstitial oxygen in the focus ring of not less than 5×10^{17} atoms/cm^3 and not more than 1.5×10^{18} atoms/cm^3. Oxygen concentration within the above-described range also avoids defects from oxygen precipitation. Furthermore, the disadvantages of introducing oxygen into the silicon focus ring, as cited by Ke, render a feature to the contrary in Applicants' claims 1 and 5 to be nonobvious. Even if a particular physical property, such as increased warpage resistance, were desired, Ke teaches away from using oxygen for this purpose, and Ke suggests no other

purpose for introducing oxygen into the silicon focus ring. Therefore, a person of ordinary skill in the art would not, at the time of the invention, combine the focus ring of Ke with the incorporation of oxygen for improved wafer structural strength of Wolf and an oxygen tolerance limit of Tamatsuka to achieve the features of Applicants' claims.

Based on the above arguments, independent claims 1 and 5 of the present invention can not be properly rejected under 35 U.S.C. §103, and therefore are now in condition for allowance. Additionally, claims 2-4 and claim 6 depending from these claims respectively should be allowed by the same reasons above plus for the additional features they recite. Accordingly, Applicants respectfully request withdrawal of the rejections of claims 1-6.

IV. Conclusion

In view of the foregoing amendments and remarks, Applicants respectfully submit that this application is in condition for allowance. Favorable consideration and prompt allowance are earnestly solicited.

Should the Examiner believe that anything further is desirable in order to place this application in even better condition for allowance, the Examiner is invited to contact the Applicants' undersigned representative at the telephone number listed below.

Respectfully submitted,

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WPB:GWT/lrd

Attachments:
Petition for Extension of Time
Letter to the Official Draftsperson

Date: December 2, 2002

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